BIOSPEC: EXECUTIVE PUBLISHABLE SUMMARY, 1st REPORTING PERIOD

Contract n°	EVK1-CT-2001-00086	Reporting period:	1 Dec 2001 – 30 Nov 2002
Title	Sensor development for routine prediction of metal biouptake in freshwaters and soil solutions (BIOSPEC)		

Objectives:

The five major overall project objectives we are working towards are: (i) rigorous comparison, both in the laboratory and in the field, of several dynamic in situ metal speciation techniques developed by us in recent years, (ii) comparison of these techniques with metal uptake by algae and plants under a range of conditions to assess the relevance of various speciation parameters for bioavailability and biouptake, (iii) to evaluate the best predictive parameters for biouptake and the best technique for reliable field application, (iv) to assess the importance of a dynamic approach to speciation for more reliable prediction of both short- and long-term biouptake, (v) application of the above developments to routine monitoring at the river basin catchment level.

Scientific achievements:

During the first 12 months, the metal speciation determined by the analytical techniques and that taken up by biota (algae, bacteria and plants) has been determined for a range of well-defined metal-ligand systems, under laboratory conditions. For fully labile complexes, all analytical techniques measure the same amount of metal species. Differences between the techniques are observed for less labile complexes, and for isolated natural ligands with distributed diffusion coefficients. These results indicate that the set of analytical techniques being deployed in the project will provide a complementary suite of information. The *in situ* deployable methods seem to be relatively free from secondary effects such as adsorption of natural ligands on the sensor surface. Studies with algae and bacteria suggest that biouptake of some metals will be best predicted by a steady-state model that incorporates the chemical species that are at equilibrium in the bulk medium. The general dynamic features of the analytical techniques have been characterised. Computational tools for prediction of the metal complex lability at the various sensors have been developed for homogeneous and heterogeneous ligands (and their mixtures) for a range of geometries, ligand to metal ratios, for both transient and steady-state conditions.

Socio-economic relevance and policy implications:

The scientifically sound, non-empirical tools that we are developing for assessment of potential metal biouptake risk will facilitate implementation of effective policy to counter water pollution throughout the EU. Our integrated approach that combines *in situ* analytical techniques and modelling, calibrated against biouptake response, will provide a cost-effective tool which can be routinely deployed by relatively unskilled personnel in institutes for water quality monitoring.

Conclusions:

Under laboratory conditions the performance of the analytical speciation techniques indicates that they are appropriate for *in situ* deployment (adequate sensitivity and minimal secondary interferences). Furthermore, the various techniques selected have a range of dynamic speciation characteristics and hence will provide complementary speciation information when deployed *in situ*. Biouptake may be best predicted by steady-state models.

Keywords: metal speciation, biouptake, natural waters, soil solutions, water quality directive